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EP 0 272 782 B1

Description

The invention relates to a load attachment device for enabling a load to be moved along a path defined by an inclined, or vertical or near vertical elongate guide member, or portion thereof, and preferably freely past any intermediate support or attachment points which may be provided for the guide element. Such a device is described in British Patent Specification No. 1582201 and corresponding U.S. Patent No. 4,265,179. The present invention provides a load attachment device which is adapted to enable the device to be releasably locked to the elongate guide member to prevent movement in at least one direction along that member, for example to provide a fall arrest facility for a person secured to an inclined, or a vertical or near vertical safety line by the device.

Our British Patent No.2,096,959 describes traversing devices for sliding along elongate members past attachment points thereof, which are provided with pivotally mounted locking cams which positively lock the devices to the elongate elements when a load attached to the device is applied in one direction along the elongate members. If such a device is used to secure a person with respect to a steeply inclined, or a vertical or near vertical safety line, there is a danger that locking of the device may not occur in a fall arrest situation. This is because, when the tension in a lanyard of a safety harness, which is hooked onto one end of the locking cam, is relieved there is no positive locking action of the device. In a fall situation where the tension in the lanyard is relieved, the device is still free to fall under its own weight down the safety line whereby no fall arrest action is achieved.

The invention seeks to provide a fall arrest device which can operate in conjunction with an elongate element which has generally horizontal stretches as well as generally vertical or inclined stretches, so as to provide free movement along the horizontal stretches whilst providing a fall arrest locking function on the vertical or inclined stretches.

EP-A-0,163,563 discloses a fall arrest device having the features of the preamble of Claim 1.

The invention provides a load attachment device being characterized by the features of the characterizing clause of Claim 1.

The wheel(s), the slipper member and the parts forming the locking assembly may be fabricated metal parts made, for example, by machining, pressing, forging or casting. Some or all of the elements of the device may be made from a suitable durable plastics material, e.g., Nylon.

The traversing device may have other forms, for example adaptations of the devices described and claimed in British Patent Specification No. 1582201 (and corresponding U.S. Patent No. 4,265,179) or in British Patent No. 2,096,958 and corresponding U.S. Patent No. 4,462,316.

A specific embodiment of the invention will now be described by way of example and with reference to the accompanying drawings in which:-

Figure 1 is a side view of a device embodying the invention;

Figure 2 is a side view of the device of Figure 1 with parts thereof removed to show the internal structure;

Referring to the drawings, there is shown a fall arrest device (40) embodying the invention which is engaged with a vertical or near vertical safety wire (11) and to which the lanyard of a safety harness can be attached. The safety wire (11) could for example be associated with a ladder and the device (10) slidingly engaged therewith provides a means of restraining a person who may slip or fall from the ladder. Moreover, as described below, the device (40) is so adapted that it can traverse locating hanger members which are engaged with the wire (11) at spaced locations therealong, without the device having to be disengaged from the wire. Such hangers may be in the form of U-shaped elements for engaging around the wire and having attachment means for securing to a fixed structure.

The fall arrest device (40) comprises a load-transfer device of the type described in my British Patent Specification 1,582,202 and corresponding U.S. Patent No. 4,265,179 for engagement with an elongate element for movement therealong whilst permitting the device to traverse intermediate support points of the elongate member without being detached therefrom. The device comprises a pair of spaced apart wheel elements (12 and 13) with a slipper member (14) being located between the wheels at a peripheral portion thereof. Each wheel (12,13) is formed with 7 radially projecting portions (15) which define therebetween 7 equi-angularly spaced recesses in the periphery of the wheel. The wheels are rotatably mounted on an axle (18). Each wheel is provided with a metal disc (16), e.g. made of steel, located against an end face of the associated wheel which is remote from the other wheel to extend partway along each recess defined in the periphery of the wheel. These discs (16), which are superficially mounted with resilient buffer elements, inhibit engagement of the wire (11) in one of the recesses defined in the wheels so as to prevent "winding-out" of the wire (11) from the load transfer device on rotation of the wheel relative to the slipper member (14). Without the disc and buffer members, such engagement of the wire (11) in a recess in one of the wheels followed by subsequent rotation of the wheel relative to the slipper member could result in complete detachment of

the load-transfer device from the wire (11).

The slipper member (14), positioned between the wheels at the peripheries thereof, has a pair of axially projecting, arcuate flanges (19) which engage in correspondingly shaped grooves (20) formed in the inner confronting surfaces of the projecting parts (15) of the wheels, thereby to locate the slipper member (14) in position between the wheels whilst allowing the wheels to rotate complete revolutions in either direction with respect to the slipper member. In this way, U-shaped hanger elements which contain the wire (11) can be received in a pair of corresponding recesses in the wheels and can pass through the device in such recesses as the wheels then rotate relative to the slipper member (14) with the parallel arms of the hanger element embracing the slipper member (14). In this way the device (40) can move up and down the wire (11) past locating hanger elements therefor without being detached from the wire (11).

The device (40) further comprises a locking assembly (41) which is located in the space between the wheels (12,13) to project radially therefrom.

The locking assembly (41) comprises a pair of elongate side plate members (42) which are fixed to one another in a spaced apart relationship by four shouldered spacer pins (43-46). Between the side plates (42), a locking cam member (47) and a load attachment link (48) are pivotally mounted on an axle (49) extending between the side plates (42).

The cam member (47) is generally triangular in shape and has rounded gripping edge formations (50) formed at the base corners of the triangle for gripping engagement with the elongate member (11) in locking conditions of the device (40). The cam member (47) has a first relatively shallow arcuate slot (51) through which the axle (18) of the load-transfer device extends. It is also formed with a second arcuate slot (52) of smaller radius which is formed at each opposite end thereof with a ball receiving pocket (53). A controlling ball (54) is disposed in the slot (52).

The link (48) projects outwardly of the locking assembly (40) beyond the side plates (42) and is provided with an aperture (55) for receiving a safety hook device provided, for example, at the end of a lanyard attached to a safety harness or a safety belt. The link (48) has a flat control surface (56) for acting on the ball (54) in a locking condition of the device. The link (48) is biassed to a position in which it extends generally perpendicular to the safety line (11) by means of a leaf spring (57), the opposite ends of which engage around pins (43 and 44) associated with the side plates (42). The spring (57) has a concave central portion which acts upon a pair of spaced pegs (58) upstanding from the link member (48).

A leaf spring, not shown, similar to leaf spring (57) and also associated with the side plate pins (43,44) is provided to act on a pair of upstanding pegs on the cam member (47) to bias the cam member to a position in which the base of the cam member is generally parallel to and spaced from the safety line (11) so that neither gripping edge formation (50) is in contact therewith. The strength of the leaf spring associated with the cam member is relatively soft compared with that of the leaf spring (57) biassing the link (48). The strength of the spring (57) is selected in accordance with the weight of the fall arrest device (40) so as to ensure maintenance of the locking condition thereof in a fall arrest situation.

The fall arrest device (40) may be used in a system in which a safety line (11) is guided along an extensive path of movement of a workman which may have both horizontal and vertial stretches and which may require the device to provide a fall arrest facility in opposite vertical dispositions thereof. For example a workman may wish to move about a scaffolding or gantry system without detaching the device from a safety line extending in a defined path around such system. The path may have a horizontal portion followed by a vertically upwardly extending portion followed by another horizontal portion and possibly thereafter a vertically downwardly extending portion. In this way, the device should provide free movement without any locking occurring during movement along horizontal stretches but should provide a fall arrest locking condition when it is moving upwardly in one vertical disposition of the device and also when the device is inverted to move downwardly along a subsequent vertical portion of the safety line.

When moving along a horizontal stretch of the safety line (11), the cam member (47) is biassed into a central position so that it is not in engagement with the safety line with the ball (54) floating freely along a central portion of the arcuate slot (52). In this condition, the device (40) will be freely movable in either direction along the horizontal portion of the life-line (11) without any locking action taking place. However when the device (40) moves from a horizontal stretch of the life-line (11) to an inclined stretch thereof which is at an angle to the horizontal of greater than a critical angle, for example 45°, the ball (54) will move under gravity to one end of this slot (52) to engage in the ball receiving pocket (53) thereat. Once the ball (54) is engaged in a pocket (53), the locking mechanism (41) will be brought into a locking condition as illustrated in Figure 4, whenever the link mechanism (48) is automatically centered under the action of leaf spring (57). In normal operation, a tension load in the lanyard is applied to the link

(48) causing the link to move to the position shown in Figure 3 and allowing the cam member (47) to be brought to its unlocked condition under the action of the leaf spring acting thereon. In a fall situation, the upward pull of the lanyard on the link member (48) no longer exists and the link (48) is automatically moved to the position shown in Figure 4 under the action of leaf spring (57) whereby the flat control surface (56) on the link acts on the ball (54) which is then firmly engaged in the ball pocket (53) thereby causing the cam member (47) to be rotated to its locking position in which a gripping edge formation (50) thereof bites into the life-line (11) to firmly grip the life-line between the formation (50) and an opposed portion of the slipper member (14).

If a second ball is introduced into the arcuate slot (52) in the cam member then the actuation of the device to provide the fall arrest facility will occur with stretches of the life-line which are inclined to the horizontal at smaller angles, for example 30° to 35° instead of the aforesaid 45°. It will be appreciated that the device is brought into this fall arrest operational condition in both directions since ball receiving pockets (53) are provided at each end of the arcuate slot (52) and gripping edge formations (50) are provided at opposite base corners of the cam member (47). Rubber buffer members (59) are provided to protect corner portions of the side plates (42) from engagement with the safety cable (11) and to provide frictional engagement therewith.

Claims

1. A load attachment device comprising a slipper member (14) adapted to engage an elongate member (11) having at least one inclined, vertical or near vertical portion, for sliding movement along the elongate member (11), and load sensitive locking means (41) having an unlocked condition permitting free sliding movement of the device and a locked condition in which a grip portion (50) of the locking means engages and grips said elongate member (11) between said grip portion (50) and said slipper member (14), said elongate member (11) being slidably engaged, in use, with the slipper member (14), wherein said locking means (41) are adapted to be maintained in said unlocked condition when said loading is applied thereto in a direction within a range defined between a line generally parallel to the elongate member (11), and a predetermined acute angle thereto, and wherein said locking means (41) comprise a pivotally mounted locking member (47) having at least said one grip portion (50) provided thereon adapted to engage and grip the elongate element (11) upon pivotal movement of the locking member (47) in at least one rotational direction, characterized in that the locking member (47) has an arcuate slot (52) therein formed with a pocket (53) at least at one end of the slot (52), the pocket (53) being adapted to receive and locate a rolling element (54) located in the slot (52), said locking member (47) being normally maintained in a position in which the at least one grip portion (50) is out of contact with an elongate element (11) engaged in use with said slipper member (14), and in that there is provided a pivotally mounted load attachment member (48) having a control surface means (56) for acting on said rolling element (54) when located in said pocket (53), whereby, when the device moves onto an inclined, or a vertical or near vertical portion of the elongate element, the rolling member (54) moves under gravity from said slot (52) into said pocket (53), the load attachment member (48) being biassed (58) so that when said loading applied thereto is removed, said control surface means (56) acts on the rolling element (54) in said pocket (53) to cause the locking member (47) to pivot and bring the at least one grip portion (50) into locking engagement with the elongate member (11) engaged with said slipper member (14).

2. A device as claimed in Claim 1 for bi-directional operation wherein said locking member (47) is formed with a pair of grip portions (50) for gripping engagement with said elongate member (11) in respective opposite rotational directions thereof and wherein a pocket (53) is provided at each end of said slot (52) for receiving said rolling element (54).

3. A device according to Claim 1 or Claim 2 including at least one rotary wheel (12,13) having radially projecting parts defining recesses formed in the periphery of the wheel at spaced locations therearound, a slipper member (14) cooperating with said projecting parts of the wheel (12,13) to allow rotation of the wheel with respect to the slipper member (14) while locating the elongate member (11) with respect to the wheel (12,13), whereby a location element can engage in a recess in the wheel (12,13) which then rotates relative to the slipper member to pass the location element through the device (40); and a body part (42-46) on which said wheel is rotatably located.

4. A device according to Claim 3 including a slider means (59) extending from said body

part (42-46) for sliding engagement with said elongate member (11) when said body part (42-46) is rotatably tilted about the axis of rotation of said wheel (12,13) to maintain a spacing between the body part (42-46) and the elongate member (11) in at least the entire area adjacent the slipper member (14), which spacing is sized to enable the free passage of a location element through the device (40), whereby the device can actuate itself to automatically traverse said location elements.

Patentansprüche

1. Lastenbefestigungsvorrichtung, die ein Gleitelement (14), das so ausgeführt ist, daß es in ein längliches Element (11) eingreifen kann, das zumindest in einer geneigten, vertikalen oder nahezu vertikalen Position angeordnet ist, um so eine Gleitbewegung am länglichen Element (11) entlang durchführen zu können, und lastabhängige Verriegelungsvorrichtungen (41) umfaßt, die einen nichtverriegelten Zustand, in dem eine freie Gleitbewegung der Vorrichtung möglich ist, und einen verriegelten Zustand aufweisen, in dem ein Greifabschnitt (50) der Verriegelungsvorrichtung in Eingriff mit dem genannten länglichen Element (11) zwischen dem genannten Greifabschnitt (50) und dem genannten Gleitelement (14) kommt und dieses ergreift, wobei das genannte längliche Element (11) während der Benutzung in gleitendem Eingriff mit dem Gleitelement (14) steht, wobei die genannten Verriegelungsvorrichtungen (41) so ausgeführt sind, daß sie in dem genannten nichtverriegelten Zustand verbleiben, wenn die genannte Last in einer Richtung innerhalb eines Bereiches auf sie einwirkt, der zwischen einer im allgemeinen parallel zum länglichen Element (11) verlaufenden Linie und einem vorbestimmten spitzen Winkel dazu definiert ist, und wobei die genannten Verriegelungsvorrichtungen (41) ein drehbar montiertes Verriegelungselement (47) umfassen, das zumindest den daran ausgebildeten genannten einen Greifabschnitt (50) umfaßt, der so ausgeführt ist, daß er in Eingriff mit dem länglichen Element (11) kommt und dieses ergreift, wenn das Verriegelungselement (47) in zumindest einer Drehrichtung eine Drehbewegung ausführt, dadurch gekennzeichnet, daß das Verriegelungselement (47) einen darin ausgebildeten gekrümmten Schlitz (52) mit einer Tasche (53) an zumindest einem Ende des Schlitzes (52) aufweist, wobei die Tasche (53) so ausgeführt ist, daß sie ein im Schlitz (52) angeordnetes Rollenelement (54) aufnehmen und festlegen kann, wobei das genannte Verriegelungselement (47) normalerweise in einer Position verbleibt, in der der zumindest eine Greifabschnitt (50) nicht in Kontakt mit einem länglichen Element (11) steht, das sich während der Benutzung in Eingriff mit dem genannten Gleitelement (14) befindet, und daß ein drehbar montiertes Lastenbefestigungselement (48) vorgesehen ist, das eine Kontrolloberflächenvorrichtung (56) aufweist, die auf das genannte Rollenelement (54) einwirkt, wenn dieses sich in der genannten Tasche (53) befindet, so daß, wenn sich die Vorrichtung auf einem geneigten oder einem vertikalen oder nahezu vertikalen Abschnitt des länglichen Elementes bewegt, das Rollenelement (54) sich unter Schwerkrafteinwirkung aus dem genannten Schlitz (52) in die genannte Tasche (53) hineinbewegt, wobei das Lastenbefestigungselement (48) so vorgespannt (58) ist, daß, wenn die darauf einwirkende genannte Last entfernt wird, die genannte Kontrolloberflächenvorrichtung (56) so auf das Rollenelement (54) in der genannten Tasche (53) einwirkt, daß sich das Verriegelungselement (47) dreht und den zumindest einen Greifabschnitt (50) in Verriegelungseingriff mit dem länglichen Element (11) bringt, das mit dem genannten Gleitelement (14) in Eingriff steht.

2. Vorrichtung nach Anspruch 1 für einen Betrieb in zwei Richtungen, wobei das genannte Verriegelungselement (47) mit einem Paar Greifabschnitten (50) für einen Greifeingriff mit dem genannten länglichen Element (11) in den entsprechenden Gegendrehrichtungen davon ausgebildet ist, und wobei eine Tasche (53) an jedem Ende des genannten Schlitzes (52) zur Aufnahme des genannten Rollenelementes (54) vorgesehen ist.

3. Vorrichtung nach Anspruch 1 oder Anspruch 2, die zumindest ein Drehrad (12, 13) mit radial vorspringenden Teilen zur Definition von am Umfang des Rades in bestimmten Abständen ausgebildeten Rücksprüngen, ein Gleitelement (14), das mit den genannten vorspringenden Teilen des Rades (12, 13) zusammenwirkt, um so eine Drehung des Rades im Verhältnis zum Gleitelement (14) zu ermöglichen, während dabei das längliche Element (11) im Verhältnis zum Rad (12, 13) festgelegt wird, wobei ein Festlegungselement in Eingriff mit einem Rücksprung im Rad (12, 13) kommen kann, das sich dann im Verhältnis zum Gleitelement dreht, um so das Festlegungselement durch die Vorrichtung (40) zu bewegen, sowie ein Körperteil (42-46) umfaßt, auf dem sich das genannte Rad drehbar bewegen kann.

4. Vorrichtung nach Anspruch 3, die eine Gleitvorrichtung (59) umfaßt, die sich vom genannten Körperteil (42-46) aus erstreckt, um für einen gleitenden Eingriff mit dem genannten länglichen Element (11) zu sorgen, wenn das genannte Körperteil (42-46) in drehbarer Weise um die Drehachse des genannten Rades (12, 13) gekippt wird, um einen Abstand zwischen dem Körperteil (42-46) und dem länglichen Element (11) in zumindest dem gesamten Bereich in der Nähe des Gleitelementes (14) beizubehalten, wobei dieser Abstand so bemessen ist, daß ein freier Durchgang eines Festlegungselementes durch die Vorrichtung (40) ermöglicht wird, wobei die Vorrichtung durch entsprechende Betätigung selbst für einen automatischen Durchgang der genannten Festlegungselemente sorgen kann.

Revendications

1. Dispositif de fixation de charge comprenant un élément de patin (14) propre à venir en prise avec un élément oblong (11) ayant au moins une partie inclinée, verticale ou presque verticale, pour un déplacement par glissement le long de l'élément oblong (11), et des moyens de verrouillage (41) répondant à la charge, ayant une condition non verrouillée permettant un déplacement libre par glissement du dispositif et une condition verrouillée dans laquelle une partie de blocage (50) des moyens de verrouillage vient en prise avec ledit élément oblong (11) et le saisit entre ladite partie de blocage (50) et ledit élément de patin (14), ledit élément oblong (11) étant en contact de glissement, en service, avec l'élément de patin (14), dans lequel lesdits moyens de verrouillage (41) sont propres à être maintenus dans ladite condition non verrouillée lorsque ledit effort lui est appliqué dans un sens dans des limites définies entre une ligne globalement parallèle à l'élément oblong (11), et un angle aigu prédéterminé formé avec celui-ci, et dans lequel lesdits moyens de verrouillage (41) comprennent un élément de verrouillage (47) monté de manière à tourner et comportent au moins ladite une partie de blocage (50) propre à venir en prise avec l'élément oblong (11) et à le saisir lors du mouvement pivotant de l'élément de verrouillage (47) dans au moins un sens de rotation, caractérisé en ce que l'élément de verrouillage (47) a une fente arquée (52) qui y est formée avec une poche (53) au moins à une extrémité de la fente (52), la poche (53) étant propre à recevoir et retenir un élément roulant (54) placé dans la fente (52), ledit élément de verrouillage (47) étant normalement maintenu dans une position dans laquelle ladite au moins une partie de blocage (50) n'est pas en contact avec un élément oblong (11) qui est en prise d'utilisation avec ledit élément de patin (14), et en ce qu'il est prévu un élément de fixation de charge (48) monté de manière à pivoter et ayant un moyen de surface de commande (56) pour agir sur ledit élément roulant (54) lorsqu'il est situé dans ladite poche (53), ce par quoi lorsque le dispositif se déplace sur une partie inclinée, ou verticale, ou presque verticale de l'élément oblong, l'élément roulant (54) se déplace sous l'effet de la gravité depuis ladite fente (52) jusque dans ladite poche (53), l'élément de fixation de charge (48) étant sollicité (58) de telle manière que lorsque ledit effort qui lui est appliqué est supprimé, ledit moyen de surface de commande (56) agit sur l'élément roulant (54) dans ladite poche (53) pour amener l'élément de verrouillage (47) à pivoter et amener ladite au moins une partie de blocage (50) à venir en prise de verrouillage avec l'élément oblong (11) en prise avec ledit élément de patin (14).

2. Dispositif selon la revendication 1 pour un fonctionnement bidirectionnel, dans lequel ledit élément de verrouillage (47) est formé avec une paire de parties de blocage (50) pour venir en contact de saisie avec ledit élément oblong (11) dans des sens de rotation opposés respectifs de l'élément de verrouillage, et dans lequel une poche (53) est prévue à chaque extrémité de ladite fente (52) pour recevoir ledit élément roulant (54).

3. Dispositif selon la revendication 1 ou la revendication 2 comprenant au moins une roue rotative (12, 13) ayant des parties en saillies radiales définissant des parties en retrait formées dans la périphérie de la roue en des emplacements espacés autour de celle-ci, un élément de patin (14) coopérant avec lesdites parties en saillie de la roue (12, 13) pour permettre la rotation de la roue par rapport à l'élément de patin (14) tout en maintenant l'élément oblong (11) par rapport à la roue (12, 13), ce par quoi un élément de fixation peut pénétrer dans un retrait dans la roue (12, 13) qui tourne alors par rapport à l'élément de patin pour faire passer l'élément de fixation à travers le dispositif (40) ; et une partie de corps (42 à 46) sur laquelle ladite roue est fixée de manière à tourner.

4. Dispositif selon la revendication 3 comportant un élément glissant (59) qui s'étend à partir de

ladite partie de corps (42 à 46) pour venir en contact de glissement avec ledit élément oblong (11) lorsque ladite partie de corps (42 à 46) est basculée pour tourner autour de l'axe de rotation de ladite roue (12, 13) pour maintenir un espace entre la partie de corps (42 à 46) et l'élément oblong (11) dans au moins la totalité de la zone adjacente à l'élément de patin (14), cet espace étant dimensionné pour permettre le passage libre d'un élément de fixation à travers le dispositif (40), ce par quoi le dispositif peut s'auto-commander pour passer automatiquement lesdits éléments de fixation.

FIG. 1

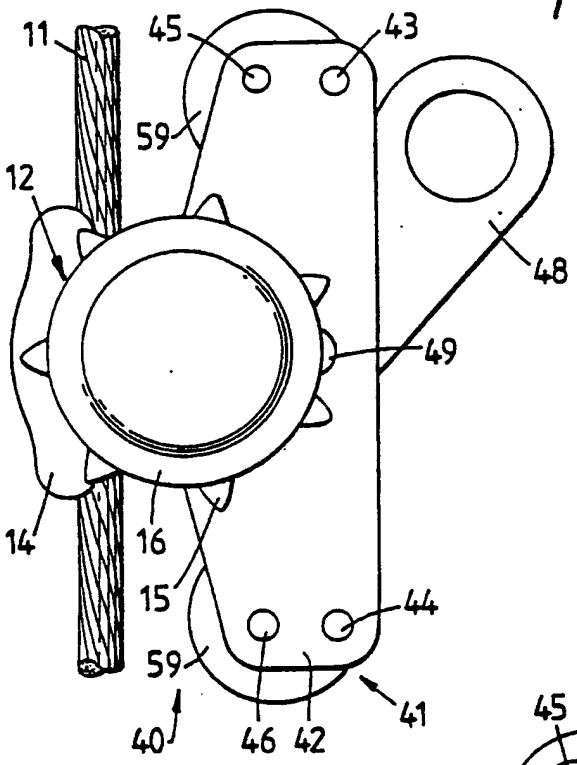

FIG. 2